UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TEXAS 75202 – 2733

March 7, 2019

Mr. Miguel Montoya
Quality Assurance Officer
New Mexico Environment Department
Surface Water Quality Bureau
P.O. Box 5469
Santa Fe, NM 87502-5469

Dear Mr. Montoya:

We have reviewed the Quality Assurance Project Plan (QAPP) entitled "*Willow Creek Watershed-Based Planning Project"* for Clean Water Act 319 Cooperative Agreement C6-996101-18 submitted by Natural Channel Design, Inc. I am pleased to inform you that it was approved on March 6, 2019.

This new QAPP will expire on March 6, 2021. Should there be any changes to the QAPP at any time, please submit a revised document to EPA for approval. If the project continues under a new cooperative agreement and there are no substantive technical or programmatic changes, please submit a letter stating that no changes are needed. The letter or revised document is due at least 60 days prior to the expiration date.

Attached is the completed QAPP signature page for your records. In any future correspondence relating to this QAPP, please reference QTRAK #19-184. If you have any questions, you may contact me at (214) 665-2773.

Sincerely,

Leslie C. Rauscher

Leslie Rauscher
Project Officer
State/Tribal Programs Section

Attachment; sent via email, no hardcopy to follow.

Natural Channel Design, Inc.

2900 N. West St., Ste. #5
Flagstaff, AZ 86004
928-774-2336

Quality Assurance Project Plan

for the

Willow Creek Watershed-Based Planning Project

Submitted by:

Natural Channel Design, Inc.
2900 N. West St., Ste. 5
Flagstaff, AZ 86004
(928) 774-2336

Point of contact: Allen Haden (Project Manager)
allen@naturalchanneldesign.com

January 2019

Group A. Project Management

A1. APPROVAL PAGE

QUALITY ASSURANCE PROJECT PLAN
for
Willow Creek Watershed-Based Planning Project

Approvals:

New Mexico Environment Department Surface Water Quality Bureau

Susan Styer, Project Officer, Watershed Protection Section — Date: 2.5.2019

Abe Franklin, Program Manager, Watershed Protection Section — Date: 2/8/2019

Miguel Montoya, Quality Assurance Officer, Standards, Planning and Reporting Team — Date: 2/8/2019

United States Environmental Protection Agency Region VI

Leslie Rauscher, Project Officer, WQPD, EPA Region 6 — Date: 3/6/19

Curry Jones, Chief State & Tribal Programs Section, WQPD, EPA Region 6 — Date: 3/6/19

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A2. Table of Contents

Contents

List of Abbreviations

BMP	Best Management Practice(s)
BEHI	Bank Erosion Hazard Index
DQO	Data Quality Objectives
EPA	Environmental Protection Agency
NMED	New Mexico Environment Department
NMDGF	New Mexico Department of Game and Fish
EMAP	Environmental Monitoring and Assessment
NCD	Natural Channel Design
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QAO	Quality Assurance Officer
SOP	Standard Operating Procedures
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
WARSSS	Watershed Assessment of River Stability and Sediment Supply
WBP	Watershed Based Plan
WPS	Watershed Protection Section

A3. Distribution List

Table 1 below contains the distribution list, and project roles and responsibilities for this project. The QA Officer will ensure that copies of this QAPP and any subsequent revisions are distributed to individuals who have signature authority to approve this QAPP. The SWQB Project Officer will ensure that copies of the approved QAPP and any subsequent revisions are distributed to all other project personnel listed in Table 1. All members of the distribution list who do not have signature authority to approve this QAPP will review the QAPP and sign the Acknowledgment Statement prior to initiating any work for this project. The signed Acknowledgement Statements (electronic or hard copy) will be collected by the SWQB Project Officer and will be given to the QA Officer for filing with the original approved QAPP.

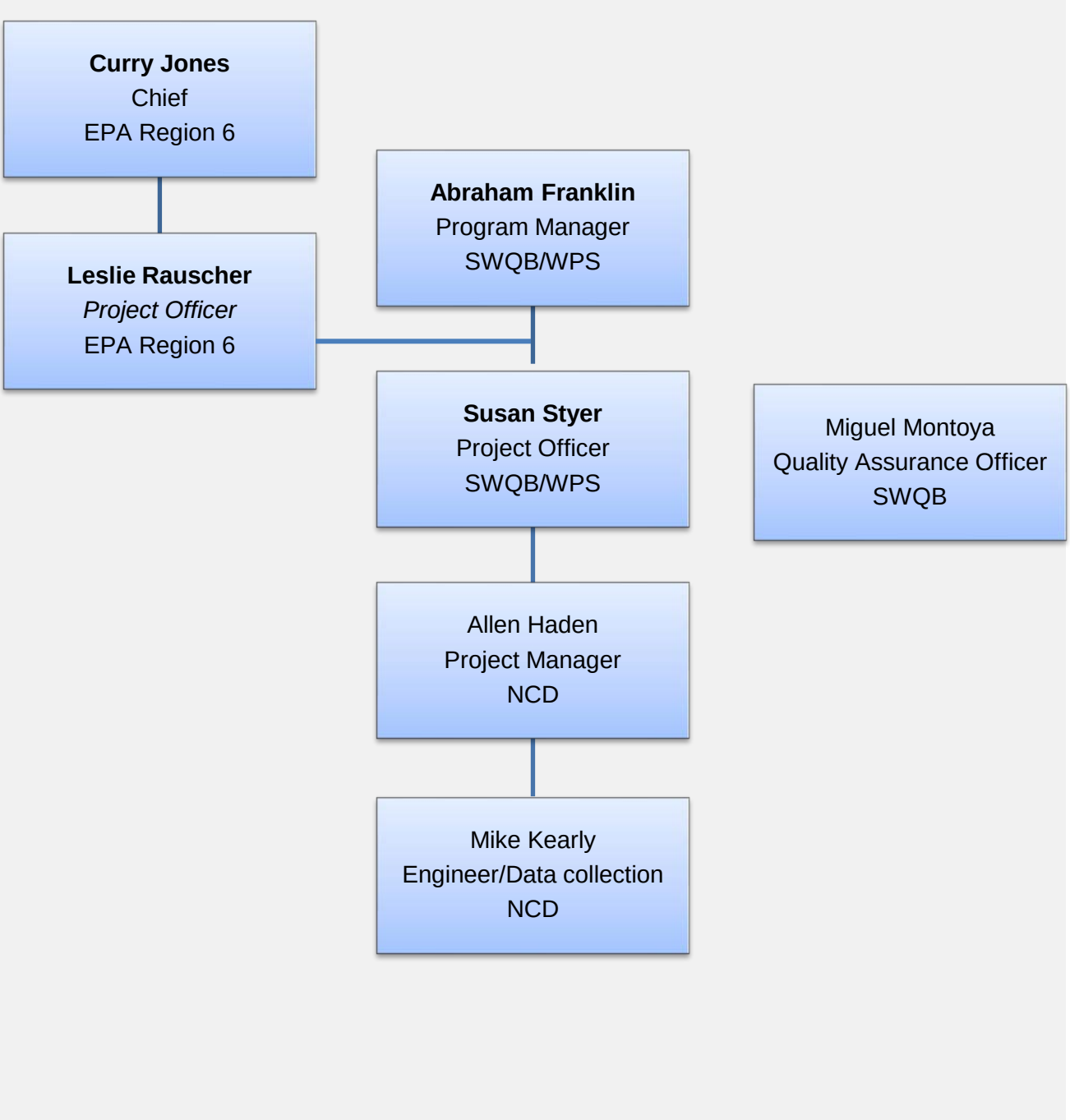
Table 1. Distribution list and staff roles

Name	Organization	Title and Role	Responsibility	Contact Info.
Abe Franklin	SWQB	WPS Program Manager	Reviewing and approving QAPP, managing project personnel and resources	(505) 827-2793 abraham.franklin@state.nm.us
Miguel Montoya	SWQB	QA Officer	Reviewing and approving QAPP, QA audits as needed to assure adherence to the approved QAPP	(505) 476-3794 miguel.montoya@state.nm.us
Susan Styer	SWQB	Project Officer	Preparing QAPP, project reporting, coordinating with contractor, and data collection	(575) 956-1548 susan.styer@state.nm.us
Allen Haden	NCD	Project Manager, Aquatic Ecologist	Project oversight, coordination, and data collection	(928) 774-2336 allen@naturalchanneldesign.com
Mike Kearly	NCD	Engineer	Data Collection, Analysis and Design	(928) 774-2336 mike@naturalchanneldesign.com
Leslie Rauscher	EPA	Project Officer Region 6	Reviewing and approving QAPP	(214) 665-2773 rauscher.leslie@epa.gov
Curry Jones	EPA	Chief, Region 6	Reviewing and approving QAPP	(214) 665-6793 jones.curry@epa.gov

A4. Project/Task Organization

The SWQB Quality Management Plan (NMED/SWQB 2018) documents the independence of the QA Officer from this project. The QA Officer is responsible for maintaining the official approved QAPP. A project organizational chart (Figure 1) displays hierarchy of the project.

Figure 1. Organization Chart



A5. Project Location and Background

The Willow Creek Watershed is located almost entirely within the Gila Wilderness Area on the Gila National Forest in western New Mexico. Less than one percent of the watershed is on private land. Much of the watershed was burned in the Whitewater-Baldy fire in 2012, 83% at a moderate to high severity.

Willow Creek is considered high quality coldwater aquatic habitat and is home to the threatened Gila trout (*Oncorhynchus gilae*). Willow Creek does not meet water quality standards for aluminum and excessive water temperature which diminishes the quality of the habitat. Willow Creek was first listed as impaired in 2014 and this is the last known water quality sample taken.

The September 2014 US EPA approved TMDL for the Upper Gila, San Francisco, and Mimbres Watersheds states that aluminum "is a major component of the geology in the greater Gila River basin, as evidenced by the predominance of alumino-silicate volcanic rocks in the region. In general, increased metals in the water column can be linked to sediment transport. This may be the case in Willow Creek, as there is a slight positive correlation between TSS and aluminum concentrations that exceed standards, as measured during the 2011 SWQB survey. Normal aqueous chemical processes, enhanced by the slight natural acidity of snow and rain, are fully capable of rendering some of this abundant, naturally-occurring aluminum available to the river system, and one would expect to see higher aluminum concentrations during the spring sampling events, as a result of snowmelt. Instead, the dataset indicates that exceedences occurred during both the spring and summer months, suggesting that the presence of it in surface water may be result of land disturbance in the watershed in addition to natural erosion and transport." Table 6.7 found in the TMDL, lists the probable sources of aluminum as campgrounds, geologic input, highway/bridge/road runoff, gravel or dirt roads, hiking trails, low water crossings, and stream channel incision. Post-fire runoff has caused an increase in hillslope and channel erosion leading to increased sediment in the stream.

The goal of this project is to collect data that will be used for an EPA approved WBP for the Willow Creek Watershed-Based Planning Project. The WBP will focus on assessing the probable sources as the cause to the Water Quality Standard (WQS) exceedances, investigating other potential sources of impairments and finally identifying solutions to water quality problems within the Willow Creek Watershed that will contribute to the overall goal of reducing stream temperatures and aluminum exceedances in the impaired reach of the watershed. This final product will be the WBP which will be used to aid in the restoration of high quality habitat for coldwater aquatic life and to meet the WQS that supports the designated use for High Quality Coldwater Aquatic Life.

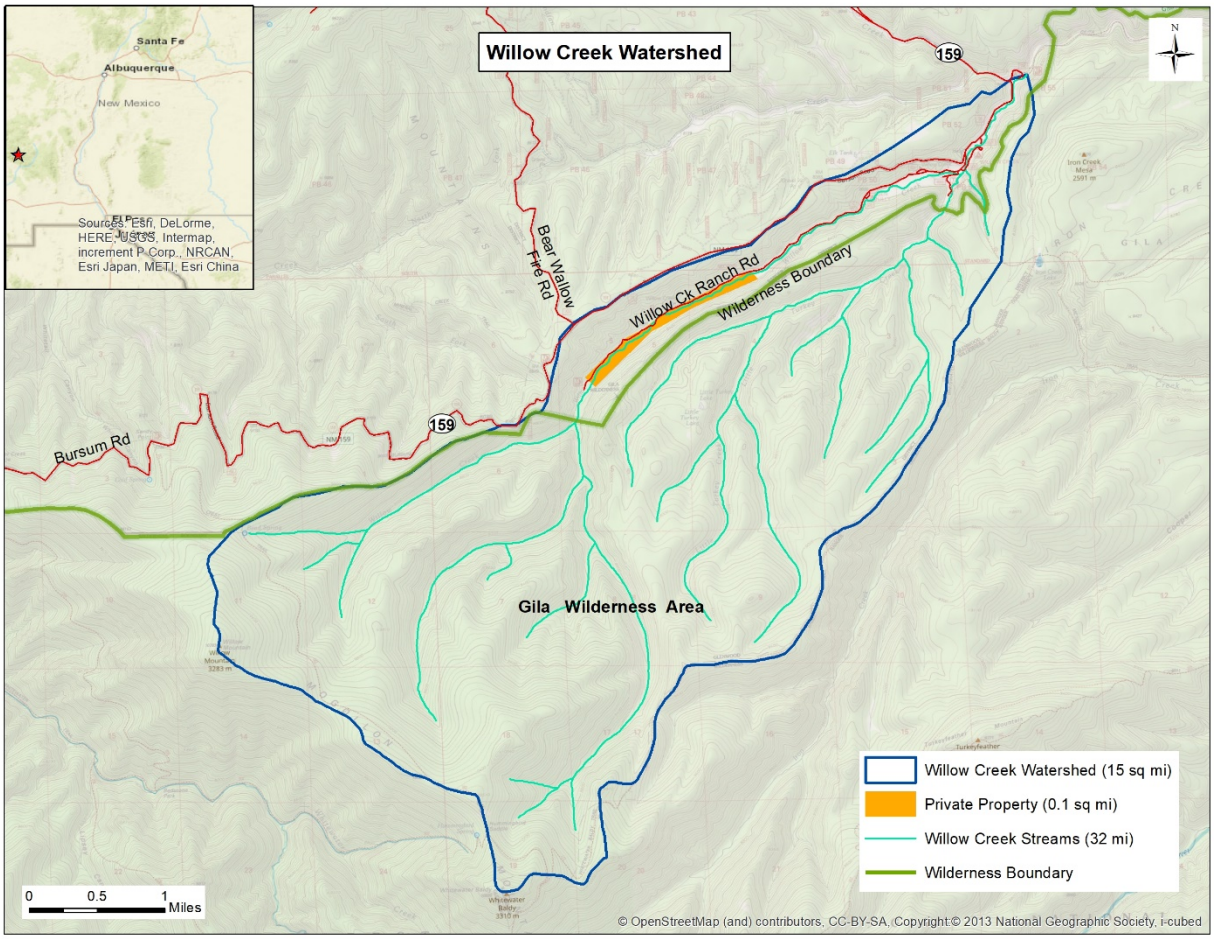


Figure 2. Willow Creek Watershed.

A6. Project and Task Description

In 2018, NCD received a Clean Water Act Section 319 Grant from NMED to develop a WBP to identify solutions to these water quality problems. As part of the plan, NCD intends to collect channel and watershed data to run Water Erosion Prediction Project (WEPP) model and the Bank Assessment for Non-point Source Consequences of Sediment (BANCS) to help determine which processes are contributing the most sediment. NCD will also use water temperature data collected by New Mexico State University (NMSU) to model temperature load reductions of different management measures using SSTEMP.

NCD will conduct a watershed-wide stream assessment. The project area encompasses the entire Willow Creek watershed (Figure 2) to its confluence with Gilita Creek around 7900' in elevation. The assessments will include measurements of stream geomorphology equivalent to Rosgen Level II surveys (Rosgen 1996), canopy cover and water temperature.

NCD will collect stream geomorphology data according to the Watershed Assessment of River Stability and Sediment Supply (WARSSS) methodology which includes stream channel type, stream condition as well as reference reach dimensions. The geomorphic surveys will consist of cross sections, longitudinal profiles, BEHI assessments, near-bank stress assessment (NBS), and pebble counts. Vegetation canopy cover and pebble counts will be collected in conjunction with stream geomorphology and at all water temperature monitoring sites.

The assessment area will include reference reaches as well as stream reaches of rapidly cooling or heating water temperatures. Reference reaches are those areas where vegetative cover is naturally very good, and where stream geometry approaches 'normal' for the valley type and watershed area. Stream geomorphology will be measured with a Trimble R8 GNSS GPS 'rover' and base station. In the few areas where tree cover may limit satellite coverage, measurements will be made with survey level and tape then tied to the overall survey as necessary with common benchmarks.

NMSU is currently collecting water temperature in eight locations in the watershed using both HOBO Water Temp Pro V2 temperature data loggers and Stream Temperature, Intermittency, and Conductivity (STIC) loggers and will continue to collect this data. Data is supplied to NCD for compilation. Vegetative canopy cover will be measured using a spherical densiometer. NCD will also ground truth aerial photos of riparian canopy cover and vegetation.

The stream geomorphology data collected will be used by NCD to develop the WEPP model to model hillslope and roadway erosion processes and the BANCS model for streambank erosion. Together these models will allow NCD to identify which processes are contributing most of the sediment input into Willow Creek. NCD will analyze the water temperature data using SSTEMP and compare with stream geomorphology measurements and canopy cover to identify areas with the greatest increases in temperature rates.

Table 2. Summary of the tasks, products, responsible party and timeline.

Task	Product	Timeline	Responsible Party
Geomorphic assessment	Cross sections, long profiles, bank erosion assessments, near-bank stress assessments and pebble counts	Spring 2019	NCD
Water Temperature data collection	Water temperature data from 8 locations	Ongoing	NCD (collected by New Mexico State University, compiled and QC'd by NCD)
Stream canopy data collection	Percent cover of stream-side vegetation	Concurrent with geomorphic assessment.	NCD

A7. Quality Objectives and Criteria for Data

Data Quality Objective
The quality of the data will be adequate to provide a high level of confidence for results derived from the described sediment and water temperature models.

Measurement Quality Objectives
The measurement quality objectives will be sufficient to achieve the Data Quality Objectives (DQO). Water temperature measurements will reflect the accuracy and precision of the instruments, stream

geomorphology (cross sections and long-profiles) will reflect the manufactures specifications for accuracy of the survey equipment (Trimble R8 GNSS), summarized in Table 3.

The anticipated accuracy and precision for BEHI, NBS, pebble counts, and canopy coverage measurements are also provided in Table 3. Measurements on bank height and other features will be collected to the nearest 0.1 feet and are adequate to accurately calculate the index. BEHI and NBS components dependent on visual estimation (percent vegetative cover and protection, etc.) are susceptible to observer bias. NCD will utilize observers trained in the BANCS methodology and coordinates all observers by doing one site as a team prior to data collection to ensure that all team members are precisely making estimates. Additionally, specific reaches are remeasured by all members of the team individually so that any systematic observer error can be eliminated. Deviation of 10% or more in visual scoring will lead to different summary scores and categories. This level of deviation can be detected by repeat surveys with different observers.

Pebble counts are measured in millimeters using a ruler for all larger size classes. A minimum of 100 points are measured at evenly spaced intervals across the channel to ensure a representative sample has been collected for each pebble count survey. Measurement errors are usually not enough to systematically change sorting bin categories within the pebble count method. However, bed material size is estimated by feel for sand and silt particles, which requires some training and calibration for each collector. NCD will utilize observers trained in Rosgen's pebble count methods and, as mentioned above, will collect all data at one site as a team to calibrate field collectors' estimates with one another.

Use of the spherical densiometer for canopy cover estimate requires minimal training to ensure that no systematic errors are made. Korhonen et al. 2006, have demonstrated that canopy coverage estimates using a spherical densiometer range from 0- 10% deviation from the true value.

Table 3. Anticipated numerical measurement quality expectations for this project.

Parameter	Accuracy*	Precision+
Water temperature	+/- 0.21 °C	+/- 0.1 °C
Stream geomorphology (cross section, long pro and NBS)	3.0mm horizontal 3.5mm vertical	+/- 1 ppm horizontal +/- 0.4 ppm vertical
Stream geomorphology (BEHI, NBS and pebble count)	+/- 10%	+/- 5%
Stream Canopy	+/-10%	+/- 5%

*Defined as the deviation from true value
+Defined as the closeness of two or more measurements to each other
"ppm = millimeters per thousand meters

This is a targeted assessment of a small watershed and the representativeness of the data is limited to the project area. No attempts are being made to infer stream condition outside the project area with these data. Similarly, the completeness of the data is limited to the project area, and only those data types which are useful in the development of a watershed-based plan to address the sediment and temperature impairment in Willow Creek.

A8. Special Training Needs/Certification

No special training or certification will be required of the cooperator, Natural Channel Design. Their staff includes licensed engineers in addition to ecologists and geomorphologists with graduate level training and decades of natural resource data collection experience. Their qualifications and experience lend confidence to the estimated accuracy and precision of the data being collected. The SWQB Project Officer will provide oversight to ensure that data collection is consistent with the current SWQB QAPP and referenced SOPs.

A9. Documents and Records

The SWQB Project Officer will make copies of this QAPP and any subsequent revisions available to all individuals on the distribution list who do not have signature authority for approving QAPP.

When changes affect the scope, implementation or assessment of the outcome, this QAPP will be revised to keep project information current. The Project Officer, with the assistance of the Quality Assurance (QA) Officer, will determine the impact of any changes to the technical and quality objectives of the project. This QAPP will be reviewed annually by the SWQB Project Officer to determine the need for revision.

Project documents include the approved QAPP, Acknowledgement Statements, field notebooks, validation and verification records, stream geomorphic data, stream canopy data, stream temperature files and QC records. These documents in hard copy or electronic form will be maintained and are the responsibility of NCD Project Manager. NCD Project Manager will ensure project documents are protected by storing and backing up data on NCD network drive or NCD computer hard drives. A copy will be made of all data and stored separately from the original data to ensure the integrity of the raw data set. NCD Project Manager will also prepare and maintain copies of project interim and final reports. NCD will keep all data for their own use in modeling. Copies of project documents will be transferred to the SWQB Project Officer biannually and stored on the SWQB Network drive in project folder. Hard copies of project documents will also be stored at the Silver City field office.

Group B: Data Generation and Acquisition

B1. Sampling Process Design (Experimental Design)

NCD will review temperature data and aerial photographs to potentially identify areas where stream conditions (temperatures, channel morphology, valley slope and width and canopy coverage) are potentially impaired or potential reference reaches. NCD will also examine aerial photos to identify potential areas of bank erosion and other sediment sources. These areas will be prioritized for measurements in the field during the assessment and survey. Use of this readily available data will improve efficiency of field time and help to categorize channel conditions for sampling.

The conceptual sampling design is that areas with little or no bank erosion, good canopy coverage (dense, mature willows), cool water temperatures and a channel morphology that is stable for the stream type serve as a desired or reference condition. Areas with bank erosion, poor canopy coverage, warm water temperatures, and stream morphology that deviate from typical for the stream type are assumed to be sources of impairment. The sampling design will seek to sample representative reference and degraded reaches within each of the representative valley types.

Three types of data will be collected: 1) Stream geomorphology, 2) Vegetative canopy cover, and 3) Water temperature. Stream geomorphology and vegetation canopy density data will be collected in Spring 2019. Water Temperature data is currently being collected by NMSU.

Stream geomorphology data will be taken throughout the project area at both reference reaches and those reaches which depart from reference condition at a minimum of eight locations. These sample locations will be used to adequately capture representative aspects of the channel for degraded and reference conditions. Locations for stream geomorphology measurements are chosen that represent areas of reference reaches and degraded reaches. A typical assessment at each reference or degraded site will include a single long-profile and multiple cross sections (minimum of 2). Stream Geomorphology data collected will also include the BEHI, NBS and pebble counts at each cross section.

Canopy coverage using spherical densiometers will also be taken at all stream geomorphology stations and at all stream temperature data logger stations. Eight stream temperature data loggers are already deployed throughout the watershed and are managed by NMSU. The data loggers were checked and the data downloaded four times in 2018. Data from stream temperature data loggers will be reviewed and analyzed by NCD during the course of the project to determine areas within the reach which exceed temperature criteria for the stream to aid in the development of the WBP. Temperature data loggers were first placed in March 2017 and the last logger was installed in August 2017 and continue to record water temperature data

B2. Sampling Methods

Cross sections and longitudinal profiles for the stream geomorphology will be measured using Trimble R8 GNSS GPS 'rover' and base station and will result in an assessment equivalent to a Rosgen Level II, (Rosgen, 1996) per methods identified in Stream Channel Reference Sites field techniques (Harrelson, 1994).

BEHI is calculated from bank height measurements and visual estimates. BEHI measurements are part of a Rosgen Level III assessment of stream stability methodology and will be collecting according to procedure identified in Watershed Assessment of River Stability and Sediment Supply (Rosgen 2006).To assess Near-Bank Stress, NCD will use methods 1, 2 or 5 from the WARSSS methodology. Method 1 is based on a visual determination and Methods 2 and 5 use geomorphic measurements.

Pebble counts are calculated based on a stratified, systematic measurement of the intermediate axis of channel bed material using Rosgen's methodology for Active Bed Riffle Pebble Count (Rosgen, 2014) which is compatible with the WARSSS methodology.

Stream temperature data is being collected by NMSU using Hobo V2 data loggers to document both the diurnal variation along the project reach as well as longitudinal trends for heating and cooling. The data loggers record stream temperature once every hour.

Vegetative canopy cover will be measured using a spherical densiometer according to the Bureau's *Physical Habitat SOP 5.0* section 6.3.3 pertaining to canopy cover.

B3. Sample Handling and Custody

Because there are no plans to collect samples for laboratory analysis, there no handling requirements.

B4. Analytical Methods

Because there are no plans to collect samples, no analytical methods are needed.

B5. Quality Control

Quality control (QC) activities are technical activities, including data verification and validation procedures, that measures the attributes and performance of a process, item or service against a defined standard which are performed on a routine basis to quantify the variability that is inherent to any environmental data measurement activity. The purpose for conducting QC activities is to understand and incorporate the effects the variability may have in the decision-making process. Additionally, the results obtained from the QC analysis, or data quality assessment, may identify areas where the variability can be reduced or eliminated in future data collection efforts, thereby improving the overall quality of the project being implemented. Quality Control mechanisms are implemented as described under the Quality Objectives and Criteria for Measurement Data identified under this QAPP. Stream morphology data will be collected using high resolution Trimble R8 GNSS GPS 'rover' and base station instrumentation that removes user error and bias in comparison to reading and recording measurements using conventional laser- level type survey equipment.

BEHI, NBS and pebble count data have the potential for observer error and bias. All observers will be trained on Rosgen methodologies for collecting BEHI, NBS and pebble count data. Quality control will be strengthened by all observers performing simultaneous BEHI and pebble count surveys on the first reach in order to calibrate visual estimates and stratification techniques.

Canopy coverage has the potential for observer error and bias. Quality control will be strengthened by following the Bureau's *Physical Habitat SOP 5.0*. Specifically portions within section 6.3.3 pertaining to percent canopy cover and having the same observer take measurements at each location. This reduces the bias affect and increases the precision of each measurement.

The temperature data is not being collected using NMED/SWQB's standard operating procedure, however, below is the standard operating procedure used by NMSU for the temperature data loggers installed on Willow Creek:

NMSU deployed all new HOBO Water Temp Pro v2 and Stream Temperature, Intermittency, and Conductivity loggers (STIC; Chapin et al. 2014) at each of the sampling locations. Stream Temperature Intermittency and Conductivity meter (STIC), is a modified HOBO Pendant Temperature/Light data logger that records temperature at the same accuracy and resolution as a Pro v2, is modified to record the presence or absence of water using conductivity and has a replaceable battery.

Prior to deployment, the loggers were checked for accuracy and waterproofness, in a 1M deep ice bath. Loggers are cleared once confirmed accurate and set to record temperature every hour in degrees Celsius. Loggers are set to start recording at 00:00 on the day after they are anticipated to be deployed.

At time of deployment, a 3 ft steel framing stake is driven into the substrate a minimum of 2 ft. The position of the stake is determined by the stream morphology. Loggers are placed in deeper reaches such as runs or pools to minimize risk of a drying event. Also, a location protected by a curve, large rock, tree, or other structure immediately upstream lowers the chances of debris in the current from damaging or dislodging the logger. Loggers are placed in PVC housing to provide protection and shade and attached through a hole in the framing stake using 10 gauge, insulated, solid copper wire. The location is recorded in UTM's, as well as the date and time of deployment. Photos are taken looking upstream, downstream, and directly over the site with the logger in the frame and photo numbers recorded to provide aide in relocation at future dates. Personnel involved in the deployment are also recorded in case contact is needed in the future. A hand drawn map is also sketched to highlight key identifying features of the area for location purposes.

Basic guidelines were followed for placement of temperature sensor. Each location is:

- representative of the reach
- well mixed
- sufficient depth to keep submerged year round
- stable and accessible
- protected from impacts or from being buried in sediment
- low in human activity to reduce vandalism

Basic maintenance checks are run on each data logger during data downloads including checking for damage, vandalism or disturbance, checking if the sensor is dewatered or buried in sediment, and evidence of fouling. Sensors are cleaned or moved as necessary and documented.

Data is checked for accuracy after download to look for missing or anomalous data. Any two consecutive readings with a change in temperature greater than 3.5°C in an hour is considered suspicious, and anything with an hourly change great than 4°C is considered a drying event.

Data is downloaded at least 3 times per year using an Onset U-DTW-1 waterproof shuttle and data logger software (HOBOware). Raw data is retained by NMSU. Raw data is provided to NCD as both CSV and HOBO file and a copy is retained by NMSU.

Data loggers will be decommissioned or replaced after 4 years of use.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

The instruments that may require testing, inspection and maintenance are the water temperature data loggers, Trimble R8 GNSS GPS 'rover' and base station, and spherical densiometer. Trimble R8 GNSS GPS 'rover' and base station will be tested against a known elevation from a nearby US Geodetic Survey marker. Spherical densiometer will be visually inspected to ensure all components (mirror and bubble level) are in working order.

Prior to deployment, the temperature data loggers were checked for accuracy and waterproofness, in a 1M deep ice bath. Basic maintenance checks are run on each data logger during data downloads including checking for damage, vandalism or disturbance, checking if the sensor is dewatered or buried in sediment, and evidence of fouling. Sensors are cleaned or moved as necessary and documented.

B7. Instrument/Equipment Calibration and Frequency

The Trimble R8 GNSS base station will be calibrated against the nearest US Geodetic Survey marker with the base station set to the same reference elevation as the survey marker. The densiometer does not require calibration other than inspection by field personnel prior to each use. Prior to deployment, the temperature data loggers were checked for accuracy and waterproofness, in a 1M deep ice bath. Calibration records will be kept by NCD Project Manager who will maintain them in the project file.

B8. Inspection/Acceptance of Supplies and Consumables

There are no supplies or consumables that could affect the quality of data related to this project.

B9. Non-direct Measurements

Hillslope and roadway data for the WEPP model will be determined using available topography data. Soil data for the Willow Creek watershed is not available online at the NRCS's Web Soil Survey; NCD will rely on local USFS specialist for soils information. There is no stream gage in the watershed, therefore NCD will model the hydrology using available models from USGS, NRCS and USFS.

Existing aerial and satellite photos of Willow Creek will be used to determine historic channel locations and riparian conditions. The most common and anticipated source is the National Agriculture Imagery Program (NAIP) imagery from the US Department of Agriculture for New Mexico. The specifications for this imagery are documented on the internet at the following location: https:llwww.fsa.usda.gov/programs-and-services/ aerial-photography/imagery-programs/naip-imagery/

B10. Data Management

Water temperature data is downloaded by NMSU at least 3 times per year using an Onset U-DTW-1 waterproof shuttle and data logger software (HOBOware). Raw data is retained by NMSU and is provided to NCD as both CSV and HOBO file. Files generated by NMSU will collected by NCD staff and sent to the SWQB Project Officer biannually. Data points contained with the logger's native file format cannot be altered and therefore not subject to accidental or intentional manipulation. Raw GPS stream geomorphology data will be housed electronically by NCD Project Manager and sent to the SWQB Project Officer by NCD Project Manager no later than 3 months after data collection. Geomorphic data will be input into RIVERMorph ®software which runs many of the geomorphic calculations and assessments. The complete RIVERMorph file for the Willow Creek watershed will be housed electronically by NCD Project Manager.

Original hardcopy project document data sheets will be kept by NCD. NCD Project Manager will ensure original hardcopy project documents are scanned and then transferred to the SWQB Project Officer no later than 3 months after data collection. The electronic project file will be uploaded to the SWQB server by SWQB Project Officer biannually. A second, duplicate project file will be maintained by the SWQB Project Officer on hard drive.

Group C: Assessment and Oversight

C1. Assessments and Response Actions

The SWQB Project Officer will provide project oversight by periodically assisting with and/or reviewing data collection efforts. The SWQB Project Officer will assess project progress to ensure the QAPP is being implemented. The QAO will conduct periodic audits, as needed. Any problems encountered during the course of this project will be immediately reported to the SWQB Project Officer who will consult with appropriate individuals to determine appropriate action. Should the corrective action impact the project or data quality, the SWQB Project Officer will alert the QAO. If it is discovered that monitoring methodologies must deviate from the approved QAPP, a revised QAPP must be approved before work can be continued. All problems and adjustments to the project plan will be documented in the project file and included in the final report.

C2. Reports to Management

An initial report after field work has been completed will be filed by NCD with the SWQB Project Officer no later than 3 weeks following completion of the field data collection. This will include days spent, data collection locations, raw data files, and any factors which may have affected data quality (personnel substitutions, equipment malfunctions, inclement weather, etc.). A final report which includes, raw data, data analysis and BMP recommendations and designs will be produced prior to the contract expiration.

The SWQB Project Officer will be responsible for maintaining project progress in the EPA Grants Reporting and Tracking System and the final report, and all other required project deliverables required to be submitted to the EPA under this contract.

Group D: Data Validation and Usability

D1. Data Review, Verification, and Validation

Data will be reviewed by the NCD prior to demobilization from the field site. Data will be considered usable if the requirements of this QAPP were followed and the data is within acceptable range limits as defined under this QAPP. Data that appears incomplete, questionable, or outside the bounds of expected values for the parameter will be flagged for review. Flagged data will be discussed with the SWQB Project Officer to determine usability. If a reasonable justification for use of the data cannot be attained, those data will not be used in analysis and restoration design unless the data can be recollected and assessed for usability. The SWQB Project Officer will review the data and conclusions derived from the described sediment and water temperature models stated in this QAPP to ensure NCD accurately identified solutions to the water quality problems stated by the SWQB in Willow Creek. EPA will review and provide approval of the WBP.

D2. Verification and Validation Methods

The Project Manager will ensure that valid and representative data are acquired. Verification of and validation of field sampling and analytical results will occur in the review of data, performed by the Project Manager in accordance with the SWQB *SOP 15.0 for Data Verification and Validation* section 6.2 Physical/Habitat Data Verification and Validation. Results of the verification process will be included in the final reports.

Verification issues include the completeness of the record, and verification of calibration. Validation issues include the review of the data for anomalous data points and removal of data points based on reasonable explanation. Verification will be completed by staff members who were not responsible for the data collection.

D3. Reconciliation with User Requirements

The user requirement is a restatement of the data quality objective: The quality of the data will be adequate to provide a high level of confidence for development of sediment and water temperature models in the Willow Creek Watershed that will be used to determined best management practice for the Willow Creek Watershed Based Plan.

If project results do not meet this requirement, then additional monitoring may be necessary to fill in data gaps or it may be necessary to extend the monitoring period to measure effects that were not apparent during the project period.

REFERENCES

Chapin, T.P.; Todd, A.S.; Zeigler, M.P. 2014. *Robust, low-cost data loggers for stream temperature, flow intermittency, and relative conductivity monitoring*. Water Resources Research 50: doi:10.1002/2013WR015158.

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Appendix 1. QAPP Acknowledgement Form

New Mexico Environment Department Surface Water Quality Bureau

Willow Creek Watershed-Based Planning Project

Quality Assurance Project Plan Acknowledgement Statement

This is to acknowledge that I have received a copy of Willow Creek Watershed-Based Planning Project Quality Assurance Project Plan.

As indicated by my signature below, I understand and acknowledge that it is my responsibility to **read, understand, become familiar with and comply** with the information provided in the document to the best of my ability.

_____

Signature

_____

Name (Please Print)

_____

Date

Return to SWQB Project Officer (Susan Styer)